

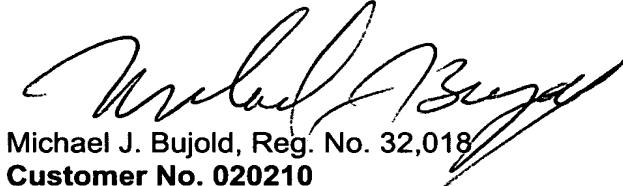
**REMARKS**

The above newly entered/amended paragraphs of the specification overcome some informalities noted in the specification. The undersigned avers that the newly entered/amended paragraphs of the specification do not contain any new subject matter.

Newly entered claims 14-25 merely rewrite the subject matter of Chapter II amended claims 1-13 in a more traditional U.S. claim format. The entered amendments are not, in any way, directed at distinguishing the present invention from any known prior art. Please consider the newly entered claims upon consideration of this application.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,



Michael J. Bujold, Reg. No. 32,018

**Customer No. 020210**

Davis & Bujold, P.L.L.C.

Fourth Floor

500 North Commercial Street

Manchester NH 03101-1151

Telephone 603-624-9220

Facsimile 603-624-9229

E-mail: [patent@davisandbujold.com](mailto:patent@davisandbujold.com)

[001] **ARRANGEMENT FOR SECURING A SNAP RING**

This application is a national stage completion of PCT/EP2004/000296 filed January 16, 2004 which claims priority from German Application Serial No. 103 02 075.6 filed January 21, 2003.

[002] **FIELD OF THE INVENTION**

[003] ~~According to the preamble of claim 1, t~~ The invention relates to an arrangement for axial support of two jointly rotating components by means of a snap ring.

[004] **BACKGROUND OF THE INVENTION**

[005] The axial support by way of a snap ring of components, for example, of a ball bearing or a gear wheel, jointly rotating upon a shaft, is already known. The snap ring is not closed, but has a gap extending in peripheral direction and, therefore, its outer or inner diameter can be changed by elastic deformation. The snap ring is held on the shaft in a narrowly tolerated annular groove. The snap ring can also be inserted in an annular groove of a hollow part such as a hole. The snap ring is conventionally secured on its groove only by its tension. Under certain operating conditions, like high peripheral speeds associated with vibrations, said spring tension does not suffice to keep the snap ring in its groove. On the contrary, it can happen that the snap ring emerges from its groove and thus can no longer fulfill its function of axial fixing function. This can result in sensitive damages.

[006] The object of this invention is, therefore, to provide for an arrangement of the above mentioned kind of snap ring securing device which prevents the snap ring from leaving its annular groove with no further added expenses resulting.

[007] This problem is solved with the features of claim 1. According to the invention, ramps are provided in the area of the impacting ends which prevent the snap ring from springing in or out in the area. The impacting ends are thus secured with a positive fit against radial movements. Depending on whether the snap ring is situated in a hole or on a shaft, the ramps are disposed either radially within or radially without the impacting ends.

[008] SUMMARY OF THE INVENTION

[009] Advantageous structures of the invention result from the sub-claims. With each impacting end, a single ramp is coordinated, which presents a springing in or out of each impacting end in radial direction. Between the two impacting ends, it is advantageous to situate one stop in the peripheral gap which presents a twisting of the snap ring. Thereby the impacting ends of the snap ring are kept in the sphere of action of the ramps and the snap ring can no longer spontaneously leave the annular groove. The stop between the two impacting ends can be advantageously designed as knobs. Knobs and ramps have an axial extension in the area of the axial thickness of the snap ring, preferably somewhat smaller. It is further advantageous that the components be designed as sheet metal components and the ramps and/or the knobs be stamped from the sheet metal component or components. Such a stamping is practically neutral in cost, since the stamping tool concerned requires only a small change. It is further advantageous that the ends of the snap ring be designed before the impacting ends non-torsionally around an axis extending in peripheral direction. This is of advantage in the assembling of the snap rings mounted in the annular groove since the snap ring ends slide over the ramps during the assembly becoming axially twisted and finally snap in or lock behind the ramps. It is an advantage of the snap ring if per se too non-torsional to reduce the cross-section in radial direction. By way of this simple step, the desired torsional stiffness is obtained in the area of the impacting ends. Finally, it is advantageous that the supported and/or to be supported sheet metal components are parts of a multi-disc clutch, that is, disc carriers. Snap rings are used under extremely limited installation conditions for axial fixing of a disc set under axial pressure and are also, at the same time, subjected to vibration stresses. The inventive securing of the snap ring by way of ramps and knobs is of particular advantage in this embodiment of a multi-disc clutch.

[010] BRIEF DESCRIPTION OF THE DRAWINGS ◆

[011] ~~In the drawing is shown an embodiment of the invention that will be described in detail herebelow. The drawing shows The invention will now be described, by way of example, with reference to the accompanying drawings in which:~~ ◆

[012] Fig. 1 is an axial section through a multi-disc clutch of a motor vehicle transmission; ◆

[013] Fig. 2 is a view in axial direction on the multi-disc clutch according to Fig. 1; ◆

[014] Fig. 3 is a partial view in perspective of a snap ring securing device; ◆

[015] Fig. 4 is a simplified transverse section along the line IV-IV in Fig. 3; ◆

[016] Fig. 5 is a partial view on the component to be supported with a snap ring securing device; ◆

[017] Fig. 6 is a section along line VI-VI in Fig. 5; ◆

[018] Fig. 7 is a snap ring; and ◆

[019] Fig. 8 is a detail X from Fig. 7. ◆

[020] DETAILED DESCRIPTION OF THE INVENTION ◆

[021] Fig. 1 shows a multi-disc clutch 1, that is, a shifting element of an automatic transmission for a motor vehicle. The multi-disc clutch 1 has one outer disc carrier 2 and one inner disc carrier 3, which is non-rotatably connected with the outer disc carrier 2. Within the outer disc carrier 2 is situated one disc set 4 which is pressed against a snap ring 13 by a hydraulically actuatable gearshift piston 5. The snap ring 13 is held in an annular groove of the outer disc carrier 2 and dimensioned so as to need no additional securing. The inner disc carrier 3 has one front flange 3a which is situated directly adjacent the snap ring 13, but without contact, and is fixed axially in one direction by a secured snap ring 6. In the opposite direction, the front flange 3a abuts preferably on three front surface areas 2b of the outer disc carrier 2. The snap ring 6 - contrary to the snap ring 13 - is of lesser dimensions for reasons of space and function and, to that extent, is in danger of coming out. Therefore, it has a securing device described below. ◆

[022] Fig. 2 shows a view in axial direction on the inner disc carrier 3 and the snap ring 6 which is overlapped by the outer disc carrier 2 by trapezoidally designed crimpings 2a (disc toothing of the outer disc carrier 2). The inner disc carrier 3 is secured opposite the outer disc carrier 2 via radial projections 3b axially in one direction and by the snap ring 6 in the other direction. In the area X, surrounded by a dotted line, the snap ring 6 is split (as shown as detail X in perspective representation in Fig. 3) and only for the part 3 in Figs. 5 and 6.

[023] In a perspective representation, Fig. 3 shows one section in the area of the detail X of Fig. 2. The snap ring 6 has two impacting ends 6a, 6b between which extends a peripheral gap 7. The snap ring 6 is overlapped by the radial crimpings 2a and held in axial direction. Radially within the impacting ends 6a, 6b so-called support ramps 8, 9 are situated upon the inner disc carrier 3. In the area of the peripheral gap 7, a knob 10 of approximately circular design is situated on which abuts the impacting end 6a. A peripheral gap x remains between the non-abutting side of the knob 10 and the other impacting end 6b.

[024] Fig. 4 shows a simplified partial section along the line IV-IV in Fig. 3, that is, radially situated within the impacting end 6b through the impacting end 6b and the ramp 9. The ramp 9 forms an interruption and is stamped from the inner disc carrier 3 designed as a sheet metal part that is integral therewith. In the outer disc carrier 2, an annular groove 11 is located in which is inserted and axially fixed the snap ring 6 with its impacting ends 6a, 6b. Against the area of the snap ring 6 or 6b radially projecting inwardly from the annular groove 11, the front flange 3a leans with a front face 3c so that the inner disc carrier 3 is supported in axial direction.

[025] Fig. 5 shows a partial view of the inner disc carrier 3 in the area of the detail X in Fig. 2, that is, the approximately rectangularly designed ramps 8, 9 and the knobs 10 situated between the ramps but radially somewhat outside.

[026] Fig. 6 shows a section along the line VI-VI in Fig. 5 wherein the splines of the ramp 9 and of the knob 10 can be seen. The axial extension a of knobs 10 and the axial depth b of the ramp 9 or 8 are in the area of the axial extension of the snap ring 6. The knob 10 is also stamped from the sheet metal component 3. To that extent, both the ramps 8, 9 and the knobs 10 can be produced easily and

without added working operation integral with the disc carrier 3. The axial depth a of ramps 8, 9 and the axial depth b of the knobs 10 are preferably smaller than that of the snap ring 6.

[027] Fig. 7 shows the snap ring 6 as a separate component. Its radial extension is designated with B. The snap ring has throughout its periphery this dimension B - with the exception of two recesses 12, which are situated in the area of the peripheral gap 7 and of the impacting ends 6a, 6b.

[028] Fig. 8 shows a detail X in the area of the peripheral gap 7 and of the recess 12 of Fig. 7. Both impacting ends 6a, 6b form the peripheral gap 7 between them. The impacting ends 6a, 6b have the dimension B in the area of the peripheral gap. On the impacting end 6a, on the side remote from the gap 7, a recess 12 attaches itself, which results in a reduction of the height of the snap ring designed with C. In the area of this reduced cross-section is plotted a somewhat tangentially extending axis Y-Y which forms the torsion axis of the snap ring 6 in this area.

[029] The function of the snap ring 6 is explained as follows: the snap ring 6 is first mounted, that is, threaded in the annular groove 11 (Fig. 4). This takes place approximately up to the position shown in Fig. 3, that is, the impacting end 6b lies approximately flush with the ramp 9. The other impacting end 6a obviously is not met in the annular groove, but somewhat radially within, that is, seen in axial direction before the ramp 8; the cross-section of the snap ring being axially twisted. In the embodiments according to Fig. 8, this means that the impacting end 6a is axially twisted around the torsion axis Y-Y opposite the cross-section designated with C. Accordingly, in order to adapt the torsional forces or torsional torques that appear, the snap ring cross-section has become correspondingly reduced (the snap ring cross-section thereby became torsion weaker) in the embodiment according to Fig. 8. In order finally to bring the axially twisted impacting end 6a to its position in the annular groove 11, it is pressed radially outwardly rebounding to its axial twisting, according to Fig. 4, and is thus simultaneously snapped behind the ramp 8. The radially inwardly springing out from the groove 11 is now blocked by the two ramps 8, 9. In order that the snap ring 6 does not move in peripheral

direction ad the impacting ends 6a, 6b would possibly be offset opposite the ramps 8, 9, the knobs 10 are placed in the area of the peripheral gap 7 or between the ramps 8, 9. Only a small peripheral play x (Fig. 3) is thus possible, but it is selected so that the ramps 8, 9 lie always within the impacting ends 6a, 6b.

[030] The invention has been explained above with reference to one embodiment, namely, a multi-disc clutch with an outer and an inner disc carrier, that is, with a snap ring, which is located in a hole or a hollow cylindrical component. But it is also within the scope of the invention to mount the snap ring upon a shaft or upon the outer surface of a cylindrical component. In this case, the ramps would have to be disposed radially outside the snap ring to prevent the impacting ends from radially springing out.

Reference numerals

- 1 multi-disc clutch
- 2 outer disc carrier
- 2a crimping (disc toothing)
- 2b front face area
- 3 inner disc carrier
- 3a front flange
- 3b radial projection
- 3c front face
- 4 disc set
- 5 shift piston
- 6 snap ring (secured)
- 6a impacting end
- 6b impacting end
- 7 peripheral gap
- 8 ramp
- 9 ramp
- 10 knobs
- 11 annular groove
- 12 recess
- 13 snap ring (not secured)